COST SURVEY OF GARBAGE HEAT TREATMENT IN NEW JERSEY AS COMPARED WITH A MASSACHUSETTS SURVEY

By Paul E. James and Harry J. Eby, Jr., Animal Disease Eradication Branch, Agricultural Research Service, United States Department of Agriculture 1/

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By December 1, 1955, considerable progress had been made in New Jersey on the heat treatment of garbage for swine disease control. Since the equipment used there, including the boiler sizes, was more nearly like that recommended by the United States Agricultural Research Service and the United States Public Health Service 2/ than the equipment used in any other State, a cost survey was planned in New Jersey. It was to duplicate as closely as possible a survey that had been run in Massachusetts. 3/ The purpose of the study was to compare the cost of garbage heat treatment in New Jersey with that in the Massachusetts survey, especially the effect of the equipment used in New Jersey on overall costs.

EQUIPMENT

Generally the equipment used in New Jersey was new and, contrary to the Massachusetts survey, most installations were insured. One feeder paid $22 more over a 3-year period to have his boiler insured and regularly inspected by the insurance company than he would have paid for the mandatory State inspection. However, he was $38 ahead when the insurance company paid him $60, because a part of the equipment froze and cracked one winter.

Almost all the New Jersey equipment was of one type--a steam boiler connected to injector pipes in the bottom of a truck. Many Scotch marine boilers were used. The New Jersey equipment was similar to one type used in the Massachusetts survey. In that survey three types were used: (1) Factory-made direct fire equipment, (2) a steam cleaner and injector pipes, and (3) a steam boiler and injector pipes. Since the first two are suitable for only small loads of less than 1 cubic yard, they were not used in New Jersey, where the loads were larger. The horsepower of the New Jersey boilers ranged from 20 to 200. The two largest had preheaters on the oil supply line.

1/ In cooperation with Rutgers University, New Brunswick, N. J.

2/ James, Paul, and Weaver, Leo. Equipment for the Heat-Treatment of Garbage To Be Used for Hog Feed. Sup. No. 1. 18 pp. U. S. Agr. Res. Serv. and U. S. Public Health Serv. 1954.

3/ James, Paul E., and Eby, Harry J., Jr. Garbage Heat Treatment in Massachusetts. 7 pp. U. S. Agr. Res. Serv. n. d.

The New Jersey installations with two truck shelters are shown in figures 1 and 2. The other New Jersey installations had only one shelter.

METHOD

As in the Massachusetts survey, a study was made of the cost of the equipment on the premises where it was used. Since the type tested in New Jersey lasts about 15 years, the cost per year was based on the total cost of the equipment divided by 15. In general, no boiler compound was used at the New Jersey installations.

The time of year coincided with that in the Massachusetts survey in order to have as nearly the same outside temperatures as possible. To have compared fuel costs during the winter in one location with those during the summer in another would have been illogical. No attempt was made to get cost figures on operations in which wood, coal, or old tires were used as fuel.

Since some types of garbage require a longer heating time because of poor heat penetration, various types were used in New Jersey, including military, restaurant, street, and a general category of "other," which comprised poultry offals, slaughterhouse waste, and packing-plant waste.

Although garbage temperatures were recorded as part of this survey, normally none of the feeders record them. Since garbage loads in any one feeding operation vary in size and type, the heat-treatment time should be established as that of the largest and most difficult load. However, this time may have to be increased in cold weather. More efficient operation is attained when the feeder watches the temperature of the garbage during the heating period, so that he knows when to stop the heat.

For economy, the steam volume should be reduced after approximately the first hour of operation. During the first hour the steam immediately condenses when it comes in contact with the cold garbage. However, as the garbage becomes warmer, less steam is required, but it must remain in contact with garbage longer to condense and lose its heat.

For efficient operation, the garbage should be stirred in order to reduce the size of the cold areas and place the cold garbage in contact with the hot. Excellent heat insulators and deflectors when left undisturbed include cornhusks, leafy vegetables, dough, and aluminum piepans and foil.

In New Jersey the amount of garbage per cubic yard was tabulated at the completion of the heat treatment. The quantity of garbage heated per year was based on the estimated average daily volume. Costs were given on a per-cubic-yard basis because of considerable variation in the consistency of the garbage. However, water in varying amounts usually was added to the garbage--in general, the more paper and trash, the more water--so that the end products weighed about the same.

Figure 1. --Heat-treatment installation, Westville, N. J.

Figure 2.--Heat-treatment installation, Vincentown, N. J.

DISCUSSION OF RESULTS

The results of the New Jersey study are shown in table 1.

The cost of equipment varied greatly, because some feeders had such necessary materials as pipe on the farm, which could be used instead of purchasing new pipe. The cost of installing the equipment also differed greatly, because some feeders were able to assemble their equipment themselves, whereas others paid for this labor.

The life of the equipment varied considerably. Just as with an automobile, a careful operator who keeps his equipment in good repair may be able to operate it much longer than a careless operator with the same equipment.

The heat-treatment cost was high at one installation (No. 17), because the steam valve was left wide open until the heating was finished. Large quantities of steam poured from around the loose-fitting lids. This waste of steam resulted in the highest fuel cost per cubic yard of garbage for installations with large boilers, even though the feeder used the least expensive oil. The high total cost per cubic yard for the installation (No. 19) with radial pipes and conveyor belt for loading the truck was primarily due to the high depreciation and maintenance cost of the equipment. The low total cost for the most economical installation was due to the efficiency of the boiler and its operation at full capacity. Immediately after one load was heated, another was started.

Large loads, especially those over 10 cubic yards, were heat-treated more economically than small loads.

The cost of electricity to operate the equipment was too low to have any appreciable effect on the overall cost.

The average total cost of heat treatment per cubic yard of garbage in the New Jersey and Massachusetts surveys was as follows:

Installations with --	New Jersey	Massachusetts
Small boilers	$0.565	$1.05
Large boilers	.453	.92

CONCLUSION

The cost of garbage heat treatment in New Jersey was about one-half that in Massachusetts, primarily because of the equipment, which was much more efficient and economical. The New Jersey equipment, which was similar to that recommended by the United States Agricultural Research Service and the United States Public Health Service, had closely fitted lids on the trucks and efficient boilers of satisfactory size. The Massachusetts equipment had poorly fitted lids or no covers and inefficient boilers and steam cleaners, with no blow-off valves and steam holes too large for economical operation.

Table 1.--Description of Equipment, fuel, and garbage and cost analysis

No. of the premise	Equipment: Boiler	Equipment: Truck: Width	Equipment: Truck: Length	Equipment: Truck: Depth	Equipment: Truck: Pipes: Number	Equipment: Truck: Pipes: Space between each	Oil 1/	Garbage: Type 2/	Garbage: Loads per week	Garbage: amount per load
	Horsepower	Feet	Feet	Feet		Inches	Gallons		Number	cubic
Installations With										
1--------	35	7.5	14	2.5	8	12	19	R-------	18	10.1
2--------	40	7.5	14	3	7	14	24	S(clean)-	15	11.6
3--------	50	8	14.5	2.2	7	14	19	M/S-----	20	8.6
4--------	50	8	14	3.2	8	13	25	R-------	6	12.4
5--------	50	7.5	14	2.7	7	14	22.5	S-------	11	10.7
6--------	35	7.5	12	2	7	15	18	S-------	6.5	6.6
7--------	35	7.2	12	1.6	6	16	11	½R/½S---	6	4.3
8--------	50	7.5	12	3	7	14	21	S-------	6	6
9--------	50	7.7	14	2.2	7	15	32	R-------	8.5	9
10-------	50	7	14	2	7	14	18	R/S-----	4	7.3
11-------	50	6.5	14	2.5	7	12	25	S-------	4	6.75
12-------	20	4	4	4	5	12	7.5	R-------	7	2.3
13-------	50	8	16	1.7	7	14	21.3	R-------	5	8.2
Average	----------									
Installations With										
14------	75	7.5	16	2.5	7	14	38.5	1/3/2/3S-	12	19.4
15------	75	7	12	3.1	7	12	25.7	R-------	21	9.35
16------	150	8	15	2.6	7	14	84	R-------	34	11.83
17 4/----	200	8	15.5	2.6	7	13	165	R-------	35	11.05
18------	100	8	14.7	2.5	7	14	45	S-------	9	10.75
19 5/----	125	----	-----	9	---	-----	47.7	O-------	13	20.
Average	----------	-------	-------	-------	-------	----------	---------	---------	-------	-------

1/ Grade No. 2 used at all installations, except Nos. 4 and 6 at installations Nos. 16 and 17, respectively.
2/ M-- Military, R- restaurant, S- street, and O- other.
3/ Includes insurance where applicable.
4/ Truck had poorly fitted lid.
5/ Radial pipes, 9 feet in diameter, used.

at various garbage heat-treatment installations in New Jersey, March 1956.

Small Boilers

Amount per year	Equipment per year	Depreciation and maintenance per year	Oil per gallon	Cost: Boiler compound per cubic yard of garbage (A)	Cost: Oil per cubic yard of garbage (B)	Cost: Depreciation per cubic yard of garbage (C)	Total 3/ (A+B+C)
Yards	Cubic yards	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
9,450	6,300	630	0.138	----------	0.259	0.067	0.326
9,000	2,570	590	.129	----------	.267	.065	.332
9,000	7,000	535	.136	0.019	.30	.060	.379
4,400	7,000	466	.142	----------	.288	.106	.394
6,120	7,650	765	.129	.030	.271	.125	.426
2,850	8,200	546	.131	.027	.358	.191	.576
1,530	7,000	467	.138	----------	.316	.325	.641
3,100	6,000	493	.129	.030	.452	.159	.641
3,980	11,400	760	.129	----------	.457	.191	.648
1,520	7,000	467	.140	----------	.346	.307	.653
3,685	10,005	668	.129	.037	.474	.199	.710
840	3,475	286	.129	----------	.424	.346	.770
2,130	10,381	1,038	.136	.020	.354	.487	.861
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Large Boilers

12,100	9,500	633	0.138	----------	0.274	0.057	0.331
12,560	11,525	775	.115	----------	.320	.062	.382
20,880	6,650	443	.1003	----------	.3708	.0212	.392
20,100	7,000	467	.0663	----------	.458	.023	.481
5,000	10,000	1,000	.137	----------	.287	.215	.502
13,520	39,000	3,900	.142	----------	.341	.290	.631
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